Claims

1. A polynucleotide assay apparatus characterized in that it has a polynucleotide detecting cell provided with a first electrode (111, 52, 60) to which different DNA probes (13, 14, 15, 16) are fixed in luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe and a second electrode(s) (113-1, 113-2, 53, 62-1 through 62-3, 83-1 through 83-4) opposite to said first electrode; a voltage applying unit (44) for applying a voltage between said first electrode and said second electrode; and an optical detector (33, 34, 35, 36, 43, 72-1, 72-2, 246) for trapping said target polynucleotide through hybridization between said DNA probes fixed to said luminous areas and target polynucleotides (21), carrying out an extending reaction using a base (24) labeled with electrochemiluminescence (ECL) to extend said hybridized DNA probes, and thereby detecting ECL resulting from the application of said voltage; and the presence or absence of any extended chain (26) generated by said extending reaction is detected.

2. A polynucleotide assay apparatus, as stated in Claim 1, characterized in that said ECL label is a ruthenium complex or an osmium complex.

3. A polynucleotide assay apparatus, as stated in Claim 1, characterized in that said optical detector is a

pickup device (43, 266) for detecting said ECL from a plurality of said luminous areas as a 2D image.

4. A polynucleotide assay apparatus, as stated in Claim 1, characterized in that said second electrode is configured of a plurality of electrodes, said apparatus being provided with electrode selectors (62-1S through 62-3S, 91-1 through 91-4) for selecting a prescribed electrode out of said plurality of electrodes, and said voltage is applied between said electrode selected by said electrode selector and said first electrode to detect ECL from a prescribed luminous area selected out of said plurality of luminous areas.

5. A polynucleotide assay apparatus, as stated in Claim 4, characterized in that said electrode selector is provided with TFT gate lines (91-1 through 91-4) each connected to one or another of said plurality of electrodes.

6. A polynucleotide assay apparatus, as stated in Claim 1, characterized in that said first electrodes and said second electrodes are arranged on the same plane in alternate repetition in parallel in one direction, said apparatus having a device (45) for controlling the duration of the application of said voltage on the basis of the velocity of the expansion of the region in which said ECL occurs and the distance between the center line of said first electrodes arranged in alternate repetition in said one

direction and the center line of said second electrode in said one direction.

7. A polynucleotide assay apparatus, as stated in Claim 6, characterized in that said voltage is repeatedly applied.

8. A polynucleotide assay apparatus characterized in that it has a polynucleotide detecting cell provided with a first electrode (111, 52, 60) to which different DNA probes (13, 14, 15, 16) are fixed in luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe and a second electrode(s) (113-1, 113-2, 53, 62-1 through 62-3, 83-1 through 83-4) opposite to said first electrode; a voltage applying unit (44) for applying a voltage between said first electrode and said second electrode; and an optical detector (33, 34, 35, 36, 43, 72-1, 72-2, 246) for trapping said target polynucleotide through hybridization between said DNA probes fixed to said luminous areas and target polynucleotides (21) to which is coupled oligonucleotide (28) labeled with ECL.

9. A polynucleotide assay apparatus characterized in that it has a polynucleotide detecting cell provided with a first electrode (111, 52, 60) to which different DNA probes (13, 14, 15, 16) are fixed in luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe and a second electrode(s) (113-1, 113-2,

53, 62-1 through 62-3, 83-1 through 83-4) opposite to said first electrode; a voltage applying unit (44) for applying a voltage between said first electrode and said second electrode; and an optical detector (33, 34, 35, 36, 43, 72-1, 72-2, 246) for trapping said target polynucleotide through hybridization between said DNA probes fixed to said luminous areas and target polynucleotides (21) and detecting ECL resulting from the application of said voltage.

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10. A polynucleotide assay apparatus characterized in that it has a polynucleotide detecting cell provided with a first electrode (111, 52, 60) to which different DNA probes (13, 14, 15, 16) are fixed in luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe and a plurality of second electrodes (113-1, 113-2, 53, 62-1 through 62-3, 83-1 through 83-4) opposite to said first electrode; electrode selectors (62-1S through 62-3S, 91-1 through 91-4) for selecting an electrode out of said plurality of second electrodes; and a voltage applying unit (44) for applying a voltage between said first electrode and said selected electrode, wherein said target polynucleotides trapped through hybridization between target polynucleotides qualified with an ECL label and said DNA probes are detected for each luminous area selected out of said plurality of luminous areas by

generating ECL from said ECL label by the application of said voltage.

11. A polynucleotide assay apparatus characterized in that it has a polynucleotide detecting cell provided with a first electrode (111, 52, 60) to which different DNA probes (13, 14, 15, 16) are fixed in luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe and a plurality of second electrodes (83-1 through 83-4) arranged on the same plane as said first electrode, separated from said first electrode and each arranged in the central part of one or another of said luminous areas; electrode selectors (91-1 through 91-4) for selecting an electrode out of said plurality of second electrodes; a voltage applying unit (44) for applying a voltage between said first electrode and said selected electrode; and an optical detector (33, 34, 35, 36, 43, 72-1, 72-2, 246) for detecting ECL generated from the ECL label by the application of said voltage, further having a device (45) for controlling the duration of the application of said voltage on the basis of the distance between the central part of said selected second electrode and the boundary of said luminous area adjoining said luminous area in which said selected second electrode is arranged and the velocity of the expansion of the region in which said ECL occurs; wherein

said target polynucleotide trapped in each of said luminous areas is detected.

12. A polynucleotide assay apparatus, as stated in Claim 11, characterized in that said plurality of second electrodes are arranged at equal intervals in two directions.

13. A polynucleotide assay apparatus characterized in that it has a polynucleotide detecting cell provided with a first electrode (111, 52, 60) to which different DNA probes (13, 14, 15, 16) are fixed in luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe and a plurality of second electrodes (53, 62-1 through 62-3, 83-1 through 83-4) arranged on the same plane as said first electrode; electrode selectors (62-1S through 62-3S, 91-1 through 91-4) for selecting an electrode out of said plurality of second electrodes; a voltage applying unit (44) for applying a voltage between said first electrode and said selected electrode; an optical detector (33, 34, 35, 36, 43, 72-1, 72-2, 246) for detecting ECL generated from the ECL label by the application of said voltage; and a device (45) for controlling the duration of the application of said voltage on the basis of the velocity of the expansion of the region in which said ECL occurs; wherein said target polynucleotide trapped in each of said luminous areas is detected.

14. A polynucleotide assay apparatus characterized in that it has a polynucleotide detecting cell provided with a first electrode (111, 52, 60) to which different DNA probes (13, 14, 15, 16) are fixed in luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe and a plurality of second electrodes (113-1, 113-2, 53, 62-1 through 62-3, 83-1 through 83-4) opposite to said first electrode; electrode selectors (62-1S through 62-3S, 91-1 through 91-4) for selecting an electrode out of said plurality of second electrodes; and a voltage applying unit (44) for applying a voltage between said first electrode and said selected electrode, wherein said target polynucleotide trapped in each of said luminous areas is detected by detecting for each luminous area selected out of said plurality of luminous areas by generating ECL from said ECL label by the application of said voltage.

15. A polynucleotide assay method characterized in that it has a step to trap target polynucleotides by hybridizing DNA probes fixed to luminous areas in a polynucleotide detecting cell, which is provided with a first electrode (111, 52, 60) in which different DNA probes (13, 14, 15, 16) are fixed to luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe and a second electrode(s) (113-1, 113-2,

53, 62-1 through 62-3, 83-1 through 83-4) opposite to said first electrode, with target polynucleotides (21); a step to subject said hybridized DNA probes to an extending reaction using an ECL-labeled base (24) to extend said DNA probes; a step to apply a voltage between said first electrode and said second electrode(s); and a step to detect the presence or absence of any extended chain (26) generated by said extending reaction by detecting the presence or absence of ECL resulting from the application of said voltage.

16. A polynucleotide assay method characterized in that it has a step to trap target polynucleotides by hybridizing DNA probes (13, 14, 15, 16) fixed to luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe in a polynucleotide detecting cell, which is provided with a first electrode (111, 52, 60) and a second electrode(s) (113-1, 113-2, 53, 62-1 through 62-3, 83-1 through 83-4) opposite to the first electrode, with the target polynucleotides (21) to each of which an ECL-labeled oligonucleotide (28) is coupled; and a step to apply a voltage between said first electrode and said second electrode(s) and thereby detect any ECL resulting from the application of said voltage.

17. A polynucleotide assay method characterized in that it has a step to trap target polynucleotides by

hybridizing DNA probes (13, 14, 15, 16) fixed to luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe in a polynucleotide detecting cell, which is provided with a first electrode (111, 52, 60) and a second electrode(s) (113-1, 113-2, 53, 62-1 through 62-3, 83-1 through 83-4) opposite to the first electrode, with the ECL-labeled target polynucleotides (21); and a step to apply a voltage between said first electrode and said second electrode(s) and thereby detect any ECL resulting from the application of said voltage.

18. A polynucleotide assay method characterized in that it has a step to select, in a polynucleotide detecting cell provided with a first electrode (111, 52, 60) to which different DNA probes (13, 14, 15, 16) are fixed in luminous areas (3, 4, 5, 6, 61-1 through 61-6, 82-1 through 82-4) differing with the type of DNA probe and a plurality of second electrodes (53, 62-1 through 62-3, 83-1 through 83-4) arranged on the same plane as said first electrode, an electrode out of said plurality of second electrodes; a step to apply a voltage between said first electrode and said selected electrode; a step to detect any ECL generated from an ECL label by the application of said voltage; and a step to control the length of time during which said voltage is applied and held on the basis of the velocity of the expansion of the region in which said ECL occurs; wherein

said target polynucleotide trapped in each of said luminous areas is detected.

19. A polynucleotide assay method, as stated in Claim 18, characterized in that said voltage is applied and held for a length of time substantially equal to the length of time required by the expansion of the region in which said ECL occurs to reach said luminous area adjoining said luminous area in which a selected electrode out of said plurality of second electrodes is arranged.

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